An Essay on

The Sounds of the Heart

Respectfully Submitted

To the Faculty of the

Homœopathic Med. College

of

Pennsylvania

For the Degree of Doctor of Medicine.—

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February 1st

1861.

When we consider the effects which are produced upon the circulation, and through it, upon the whole animal economy by even the slightest derangements of the heart's function, we must necessarily attach the greatest importance to a correct knowledge of the action of that organ, both in health and disease. For we should be unable to appreciate or to detect the changes which it undergoes in a state of disease, without a previous knowledge of its action in a state of health. And in the study of the cardiac sounds, a knowledge of those which occur in health, with their character and causes, is requisite, before we can place a just value upon those which occur in the diseases to which the heart seems peculiarly liable.

At present there are few physicians, who, in forming their diagnosis of chest-

diseases, do not place the utmost reliance upon those signs that are elicited by means of percussion and auscultation. Indeed, it would seem almost impossible to make use of these means too much, in the detection and discrimination of diseases, unless we allow them to exclude our other means of diagnosis, which certainly no judicious physician would do.

In its healthy or normal condition, the heart gives rise to two sounds at each impulse or beat. The first, or long sound, occupies nearly one-half of the whole time taken up by one impulse and the following intermission, and occurs synchronously with the impulse or beat. The second or short sound, occurs immediately after the first, the pause or interval between them being almost inappreciable. It occupies a space of time, equal in length to about one-half of that which is taken up in the production of the first sound, or almost one-fourth of

the whole time occupied by an impulse of the heart and its corresponding interval. The remaining one-fourth of the interval is a period of silence. The first sound is dull and heavy, and the second is quick, sharp and is well defined or concentrated.

Messrs Kirkes and Paget have exhibited the length of the cardiac sounds, and their relation, as respects time, to the contraction, dilatation, and distension of the auricles and ventricles, by dividing the time occupied by a beat and its corresponding interval, into eight parts. Four of these parts, they say, are taken up by the first sound, two by the second, and two by the pause. According to these authors, during the first sound and impulse, the ventricles contract, and the auricles are partially dilated. During the second sound the auricles are fully dilated but not distended, and the ventricles are also in part dilated. Of the remaining two eighths

the first is occupied by the completion of the ventricular dilatation, and by the distension of the auricles; and during the last eighth, the auricles contract, forcing all their contained blood into the ventricles, which thereby become distended, ready for a second contraction.

Other physiologists have divided the time occupied by one impulse and its intermission into five parts, allowing two for the first sound, one for the second and two for the pause. It is likely, however, that a little difference may exist, in the length of the cardiac sounds in different individuals; age, sex, habits, temperament etc., being the modifying influences. And the nicest perception of sound and rythm is requisite to determine their length with accuracy.

"In order to give some idea of the length and character of the sounds; Dr. Williams employs the word "Lubb — dup," or "Lubb-tub"

the first part of the compound representing the first sound; and the last, the second sound." A correct idea of them, however, can be obtained only by auscultation of the living healthy subject.

Laennec supposed, from the fact that the first sound occurred synchronously with the arterial pulse, that it must be caused by the contraction of the ventricles; the second sound he attributed to the contraction of the auricles. He seems to have formed this opinion, respecting the cause of the second sound, without regarding the fact, that the contraction of the auricles takes place immediately before the contraction of the ventricles, and not succeeding it; whereas the second sound occurs immediately after the ventricular contraction, and while the auricles are in process of dilatation. Since Laennec first promulgated his opinions, there have arisen numerous theories

respecting the origin of the cardiac sounds, but, with two or three exceptions, it will not be necessary to allude to them.

A number of eminent physiologists, among whom are Billing, Rouanet, Bouillaud, etc., have attributed the first sound, to the occlusion of the auriculo-ventricular valves and the second sound, to the clacking of the semilunar valves, caused by the attempted regurgitation of the blood in the aorta and pulmonary artery. Possibly this view may be correct; but why is it that organs having so close a resemblance to each other, should produce sounds so essentially different? Although all physiologists doubtless understand perfectly the difference between the two sounds, yet few seem to have considered this discrepance in investigating the causes of the sounds. If they discovered a method, by which a sound might possibly be produced, synchronously with the impulse

of the heart, they seem to have concluded that they had acertained the manner in which the first sound was produced, without inquiring whether it was probable for such a sound as the normal first sound, to originate from the circumstance to which they ascribed it

It is probable that several circumstances combine to produce the first sound. First,— Experiment has shown that by applying a stethoscope over a muscle, its contraction causes some sound. Secondly,— The columnæ carnæ form a considerable roughness on the endocardial surfaces, and the passage of the blood over them, no doubt causes more a less sound. again there may be some sound occasioned by the blood impinging upon the tendinous cords in its passage from the ventricles. Thirdly,— the closure of the mitral and tricuspid valves, and— Fourthly — the impulse of the heart against the ribs, may each have some influence in producing the first sound. Fifthly.— Cruveilhier has

described a case of ectopia cordis in which, by placing the finger over the origin of the pulmonary artery a distinct thrill was felt. This thrill could not be felt in other parts of the base of the ventricles, showing that it could not have been transmitted from some other portion of the heart. He also found that the greatest intensity of the first sound originated in the same place as that of the second, namely,- at the origin of the large arteries. He supposed, from these observations that the first sound is produced at the entrance of the arterial trunks by the rushing of the blood through the openings. I do not think that sufficient importance is generally attached to Cruveilhier's investigations on this subject The character of the sound and the position in which its greatest intensity occurs, seem to indicate that it is caused chiefly by the rush of blood through the openings. Another phenomenon which shows the truth of

this theory, in some degree at least, is the increase in the intensity of the sound which results from the slightest degree of inflammation in the semilunar valves of the aorta.

In regard to the place from which the second sound originates, there seems to be but little difference of opinion, nearly all supposing its origin to be at the entrance of the arteries. But all do not agree in regard to the manner in which it is produced. Some attribute it to the closure of the semilunar valves, caused by the force of the returning wave of blood. Others think that at the moment when the returning wave reaches the valves they are already shut, and can therefore give rise to no sound. These same gentleman believe that the sudden stoppage of the blood in its passage back towards the ventricles, produces a violent agitation in the particles of the blood, which is transmitted through the

coats of the vessel and the walls of the thorax, to the ear of the auscultator. Dr. Hughes of Guy's Hospital compares the circumstances attending the formation of the second sound to those which may be observed in a leaden pipe which is not very firmly fixed to its solid support, and having a full stream of water passing rapidly through it. When the force of the stream is suddenly stopped by means of a stopcock, a violent agitation of the water and of the pipe will be produced, and a corresponding noise will be heard. "The only difference", says he "between the circumstances attending the second sound of the heart, and those which accompany the formation of the sound produced in the leaden pipe, is that the former occurs in living and elastic tissues, while the latter occurs in connection with comparatively inelastic tissues and with dead matter." I do not understand the

assertion of Barth and Roger, that the semilunar valves are closed before the wave of refluent blood reaches them. In what manner are they closed? They are not supplied with a muscular apparatus, by which their closure can be effected. If they close by their own specific gravity, the recumbent posture would make some difference in the sound, but so far as I can ascertain, this is not the case. And it must be remembered that the ventricular contraction does not drive the entire mass of blood to some distance beyond the valves; but so soon as the blood enters the arterial trunks, the ventricles lose all power over it. It must therefore either remain in that situation until the next recurrence of the systole, or else return into the ventricles through the partially open valves. It is also probable that at the same instant, in which the systole ceases, the coats of the vessels react upon their contained blood, and force it

back upon the semilunar valves precisely synchronously with the commencement of the diastole. Hence a regurgitation of blood through the opening is not only possible but quite probable. The second sound, therefore, probably results from the sudden and forcible occlusion of the semilunar valves, in combination with the violent agitation of the blood itself.

Having thus studied the causes as well as the character of the normal sounds of the heart, we are prepared to appreciate the changes that occur in disease, and to define, in most instances, the manner in which they are produced. In studying the causes of the various morbid sounds they may be divided into four classes. First—: Increase of the natural sounds. Secondly—: Decrease of the natural sounds. Thirdly—: Change of place at which the greatest intensity of the sound occurs. Fourthly—: Abnormal sounds or murmurs.

II. Increase of the natural sounds. This change may, and undoubtedly often does take place from attenuation of the muscular walls of the heart, or from a want of adipose tissue in the parietes of the chest. And it may be stated as a general rule, that the nearer the ear of the auscultator can be brought to the inner surface of the walls of the heart, the more intense and distinct will be the sounds. We should keep this fact constantly in mind, in making physical explorations, to make proper allowance for thickness of the muscular and adipose tissue over the precordial region. But we must not always expect to find an increase of the sounds accompanying attenuation of the walls of the ventricles. On the contrary the heart may be so enfeebled in its action that the sounds will be very materially diminished. Again if there be a certain amount of thickening of the walls of the heart, the sounds may be increased by the energetic action of the organ.

II. Decrease of the natural sounds. By the rule just stated in regard to the increase or decrease of the sounds, it follows that an excessive deposit of fat, will prevent the normal sounds from being heard with their usual distinctness, Pericardial effusion is a very frequent cause of indistinctness in the sounds. The first sound being in a great measure caused by the rush of blood from the ventricles into the aorta and pulmonary artery, it follows that weak and imperfect contraction of the organ, must diminish the intensity of the first sound; and imperfect motion in the semilunar valves, or inelasticity in the arterial coats, must likewise effect a diminution of the natural second sound.

III. Change of place at which the greatest intensity of the sound occurs. There are comparatively few instances in which the sounds of the heart are heard out of their natural

situations. We occasionally meet with an instance, in which the greatest intensity of the sounds is heard high up in the upper portion of the thorax or just under the clavicle. This change is often occasioned by consolidated lung which conveys the sound to that part of the chest, but does not prevent it from being heard in its ordinary situations, with its usual distinctness.

In pulmonary emphysema the lung sometimes extends so much as to encroach very considerably upon the space allotted to the heart, and even reaching forwards and towards the median line so as partially to fill up the space anterior to the heart and the origin of the great vessels. In this manner the heart is separated, as it were, from the ear of the auscultator by the extending lung, which in some instances almost completely prevents the sound from being heard in its natural position. Under these circumstances, we

can generally obtain a pretty correct idea of the nature of the sounds by applying the stethoscope to the scrobiculus cordis. Pleuritic or pericardiac effusion, morbid growths, aneurisms etc, may force the heart out of its proper position and thus cause the sounds to be heard in abnormal situations. An interesting case of this kind was admitted to the Pennsylvania Hospital in the summer of 1860, in the person of a strong muscular man, a member of the zouave corps of this city. The impulse and sounds of the heart were perceived quite distinctly in the left lateral wall of the thorax, two or three inches below, and to the left of the nipple; and at the same time there was a strong impulse in the second intercostal space of the right side an inch or two from the sternum, accompanied with a blowing sound, which occurred synchronously with the systole. The man died suddenly

and on making a post-mortem, examination, Dr J.F. Meigs found a large aneurism of the ascending part of the arch of the aorta, and occupying a large space in the upper portion of the chest on the right side, of the sternum. It seemed to have forced the heart downwards, beneath the left lung, and towards the left side, thereby causing the impulse and sounds to be perceived so far out of the normal situation.

IV. —Abnormal Sounds or murmurs. This class of sounds may be considered under four divisions. Viz: First— Obstructive murmurs. Secondly —, Regurgitative murmurs. Thirdly:— Regurgitative and Obstructive murmurs combined. Fourthly —, Exocardial Murmurs.

1. It is evident that so long as the blood flows smoothly and freely through its natural channels and in the proper direction, the muscular walls of the heart, meanwhile, contracting and dilating fully and regularly, and the valves

performing their functions properly, no abnormal sound will occur. But when the valves become the seat of inflammation, either through rheumatic metastasis or otherwise, a certain amount of thickening of the flaps takes place. In consequence of this tumefaction the valvular openings are contracted; the blood rushes through them with increased velocity; and excessive agitation of the blood is thereby produced, giving rise to an abnormal sound or murmur. In the early stages of the inflammation, and when the tumefaction is but slight, the disease may perhaps be indicated only by a slight harshness of the natural sound, especially if the disease exists in the aortic valve or in the valve of the pulmonary artery. As the tumefaction increases, the abnormal sound becomes more marked, and changes to a blowing or whizzing sound. This is called the "blowing sound" or "bellows murmur". When the inflammation becomes excessive, the

sounds may assume a rasping, grating or saw-
ing nature. In these cases it takes the name of
"Sawing" "filing" "grating" or "rasping murmur".

2. Perhaps the same causes, which, in many
instances, produce obstruction of the passages, often
give occasion, also, to those conditions which admit
of regurgitation, or the retrograde motion of the
blood through the openings. The inflammation
may become excessive, or there may be a consider-
able deposit of plastic matter upon the surface
of the flaps. In such cases the valves become
rough, wrinkled, and stiff, and are incapable
of approximating themselves with sufficient ac-
curacy, to prevent more or less regurgitation of
the blood. Regurgitation may result also from
hypertrophy of the heart with dilatation of the
ventricles and of the arterial trunks. The valves,
in these cases retain their normal size, and
of course are incapable of effecting a complete
closure of the valvular openings. Ulceration of

the valves is also a cause of regurgitation, and one which it may be difficult to detect, except by means of a post mortem examination.

3. The occurrence of a combination of Obstructive and Regurgitative murmurs, is probably more frequent than many have supposed. And since this concurrence of unhealthy conditions is a fruitful source of mistake, it is important that the means of detecting it should be thoroughly comprehended.

The sounds of the heart, both healthy and diseased, are mostly heard with greatest distinctness, over the portion of the heart from which they emanate; and as the morbid sounds commonly occur in the valvular openings, it is necessary to mention the position that the valves occupy in relation to certain points on the surface of the thorax.

The valve of the pulmonary artery is situated beneath the second intercostal space, a short

distance to the left of the sternum. The aortic valve lies directly beneath the sternum, opposite to the upper margin of the third intercostal space. The tricuspid valve is just below the aortic valve, almost in the median line of the body, and opposite to the fourth sterno-costal articulation. The Mitral valve is situated beneath the fourth intercostal space, or just below and a little to the right of the nipple. The sounds emanating from this valve are often heard by applying the stethoscope to the posterior portion of the chest, about opposite to the seventh or eighth dorsal vertebra and a little to the left side of the spine.

In making our investigations of valvular disease, as indicated by abnormal murmurs, we must be guided by the character of the sounds, by the position at which they are heard with the greatest distinctness, and by the time at which they occur. Thus we shall be able to determine whether the murmur is obstructive or regurgitative in

its character and also which of the valves is affected. If we observe a murmur, occupying the time of and perhaps entirely concealing the normal second sound, and originating beneath the sternum, opposite to the third rib or third intercostal space, that is:— over the origin of the aorta, we may perhaps invariably conclude that there is regurgitation through the aortic valve. If the murmurs were abnormal, and occured synchronously with the first sound, and were heard in the situation above mentioned, we should ascribe them to obstruction in the aortic valve. But if the sound were heard below the nipple, it would be indicative of regurgitation through the mitral valve. It can be detected and distinguished from the sound produced by obstruction in the aortic valves, only by the position from which it originates.

But we must remember that abnormal sounds may arise from a combination of both

obstructive and regurgitative murmurs. Thus if an abnormal sound occurs synchronously with the first natural sound, it may be attributed to obstruction in the openings of the arterial trunks, or to regurgitation through the auriculo-ventricular openings, or to a combination of both. But any one of these conditions can generally be detected by applying the stethoscope over that portion of the precordial region from which the sound emanates, and determining which of the valves gives rise to the sound; especially if we also consider the other signs of imperfect circulation, that may be presented to us, such as, blueness of the skin, congestions, etc. We also sometimes meet with instances in which obstruction exists and regurgitation occurs in the same valve. In cases of this description, if the derangement exists in the valves of the arterial trunks, the obstructive murmur will occur synchronously with the systole or first sound, and the

regurgitative murmur will follow immediately afterwards, or during the diastole of the ventricles. It will be synchronous with the second sound, but somewhat protracted; thus we will have the "See-saw" sound or "double murmur" produced. If the disease exists in the auriculo-ventricular openings, the same double murmur as in the former instance will be perceived, except that the synchronisms will be reversed. It may, perhaps, not be considered out of place to give a few examples of these sounds.

If the aortic valves be in a condition to admit of regurgitation, while at the same time they retain sufficient pliability to fall back close to the sides of the vessel and thereby allow a free passage for the blood, a murmur will be heard over the aortic valves, occupying the time of the second sound and sometimes entirely concealing it. Yet an indistinct second sound may sometimes be heard in the second

intercostal space, owing no doubt to the continued regularity of action in the pulmonary valve. But if obstruction also exists in the aortic valve, the first natural sound also undergoes a change, and we then have the double murmur. When both sounds occur in the second intercostal space; it must of course be attributed to derangement in the valve of the pulmonary artery. An abnormal sound heard just below the nipple, and occurring at the moment of the systole, is denotive of disease in the mitral valve, admitting of regurgitation through it. This sound is also sometimes audible at the left side of the spine, opposite to the seventh or eighth dorsal vertebra.

We might add other instances; but the few already mentioned will serve to show, that with a correct knowledge of the anatomy, physiology, and situation of the heart, we can rarely

fail to detect any of the pathological conditions to which the heart is subject, We must not suppose, however, that abnormal sounds are always indicative of valvular disease; nor that disease of the valves invariably gives rise to abnormal murmurs. For we shall see that another condition is sometimes necessary, in order to produce a perceptible sound.

The abnormal sounds most frequently occurring are those which emanate from the aortic and mitral valves. This is probably owing to the fact, that the left side of the heart is more liable to disease than the other side.

It has just been mentioned that abnormal sounds are not always indicative of valvular disease. Some of the causes aside from valvular derangement, and which produce sounds somewhat similar to those resulting from valvular disease, will now be considered

4 The first of these causes is pericardial in-

flammation, or an effusion of plastic lymph into the pericardial sac. In the healthy state the two pericardial surfaces are kept constantly lubricated by the serous secretion, and the movements of the heart over the lubricated surfaces, are not attended with any perceptible sound. When the pericardial surfaces are rendered rough by inflammation, or by a solid or semi-solid plastic exudation, it gives rise to a friction sound, which is repeated at each impulse of the heart. This friction sound may exist over a certain portion of the heart only, or over its entire surface. But if a deposition of fluid occurs in the sac, the sounds gradually cease. This is caused by the effused fluid pressing upon the contiguous surfaces of the pericardium, and keeping them asunder. In such cases it sometimes happens that the sounds continues to be audible at the highest portions of the heart, after they have ceased to be heard at the lower portions; but if the effusion of fluid increases, the sounds.

finally cease entirely. During the process of absorption, the sounds will again be heard first at that portion of the heart which is most elevated; (and from which, the fluid, of course, first disappears.) and afterwards over the other portions of the organ. After the inflammation has entirely disappeared, there will still remain a friction sound, which in some instances becomes permanent. If, however, complete adhesion takes place between the heart and pericardium; the sound entirely ceases. In case there is not adhesion, the deposit upon the pericardial surfaces, may in time, undergo a change, sufficient to produce a change in the character of the sound; and instead of a simple rubbing or friction sound, we may have a harsh, scraping noise or one resembling the creaking of new leather; this is the "leather sound" of the authors. Or it may assume the character of the bellows sound of the valves. In such cases it may sometimes

be difficult to distinguish between it and the bellows murmur, of the valves. Dr Hughes in describing the distinctive characteristics of the pericardial sounds; speaks as follows.—

"Pericardial sounds commonly appear to be more superficial than even pulmonary or aortic murmurs; they approximate more to a rubbing or grating noise than the endocardial murmurs, which have more of a blowing or whiffling character. They ordinarily occupy the period or a part of the period of both the diastole and the systole of the ventricles, and very commonly also a part of the interval or pause; They are in fact less decidedly <u>intermittent</u> than the valvular murmurs; they pass over the period of the natural sounds and leave an additional prolongation to be explained; and often afford the impression of a circular rubbing motion, like that of a mullar used in grinding paint, rather than of the puff or whizz of a valve. They are more

localized – i.e. – they extend less beyond the surface, by whose attrition they are produced, than the valvular sounds, because, not being produced by the agitation of the blood, they do not, so obviously, follow the course of that fluid through the vessels."

The second class of abnormal sounds, that we shall consider, and which are not the result of valvular disease, consists of those which are caused by aneurismal tumors. And here it may be remarked that a tumor of whatever kind, which presses upon the parietes of a large vessel, may, by diminishing the calibre of the vessel, give rise to an abnormal sound. This may be illustrated by pressing the stethoscope somewhat firmly over the course of a large vessel. Aneurisms, therefore, when pressing upon the vessel from which they arise, or upon another vessel, must produce more or less constriction and thus give rise to an abnormal sound.

The passage of blood into an aneurismal pouch will sometimes occasion an audible sound; especially if the entrance to the sac is somewhat contracted, or if the coats of the ruptured vessel be covered with an effusion of plastic lymph, or if the aneurism is so situated that the blood on entering the cavity shall impinge forcibly against its parietes. An aneurism of the aorta may give rise to a sound, which might readily be mistaken for the signs of valvular disease. When aneurisms occur in the arch or in the descending portion of the aorta at its upper part, the sounds resulting from the disease might be attributed to the action of the aortic valves. But when a lower portion of the thoracic aorta becomes the seat of aneurism, the sounds occasioned, might, from their position in the back, lead to the supposition of disease in the mitral valve. The diagnosis, in these cases, is

sometimes rendered exceedingly difficult, by the great similarity between these sounds and those produced by mitral regurgitation.

The third condition, whose physical signs are liable to be mistaken for those of cardiac disease, is Anaemia. The "Anaemic murmur" is heard in anaemic and chlorotic patients. The manner in which it is produced is not very definitely understood even at the present day. It occurs during the systole of the ventricles, and, from the position in which it is heard, is supposed to have its origin in the sigmoid valves either of the aorta or pulmonary artery, perhaps most frequently the latter. It is commonly a soft blowing murmur, but in some instances, partakes of the nature of the sawing sound of the valves. It is accompanied by a sharp, quick impulse. It is not improbable from this fact, that the

anaemic murmur is produced by a quick and sudden contraction of the ventricles forcing the blood with greater force through the arterial openings. It has been said that the anaemic murmur is not transmitted along the course of the great vessels; but Prof. Wood describes it as being heard quite distinctly along the carotid arteries, which fact strongly controverts the idea that it originates solely at the entrance of the pulmonary artery. A curious phenomenon connected with the anaemic murmur, and which does not seem to be fully understood by pathologists, is the "venous murmur." It is heard in anaemic or chlorotic patients, by pressing the stethoscope over the great jugular vein. It sometimes takes the name of "continuous murmur" from the fact that it is not intermittent like the arterial murmers. Some have asserted that the venous murmur may be heard behind the left sterno-clavicular

articulation, and deny, therefore, what others have unconditionally affirmed, that pressure over the vessel is necessary to its production; but why it should be heard concurrently with the anaemic murmur, does not seem to be at all understood, nor does the manner in which it is effected.

Finally there are certain pathological conditions, which occasion abnormal sounds, and which can scarcely be included under any one of the heads just mentioned, inasmuch as they seem to be dependent upon the action of the heart in connection with that of other parts or organs.

First:— a murmur, resembling somewhat, the valvular bellows sound, is occasionally heard under the edge of the sternum, opposite to the second intercostal space or the third rib, and directly over the origin of the pulmonary artery, although no disease of the valves of that artery

exists. It is generally supposed to result from some slight pressure made by a large lung upon the walls of the vessel during the act of inspiration; as it is only during that time that the sound is audible. This phenomenon is, however, of very rare occurrence.

Secondly:— there is another sound, which resembles the one just mentioned, in the fact of its being heard only during inspiration, or at least acquires its greatest intensity during that time. It can be heard, only after adhesion has taken place between the heart and the pericardial sac. Under these circumstances, an inflammation occurring in that portion of the pleura which is in contact with the pericardium, must give rise to a friction sound, similar to the pericardial friction sound, before described. But it may be easily distinguished from pericardial rubbing, by the synchronism of its intensity with inspiration.

It will be remembered that a doubt was expressed, of abnormal sounds being always produced by valvular disease. Very slight obstruction is not necessarily capable of occasioning any sound. But there must also be a certain amount of force exerted upon the column of blood in its passage through the diseased valve, in order to effect agitation sufficient to produce an abnormal sound; hence if an individual of an equable temperament be affected with slight obstructive valvular disease, there may not be sufficient power in the ventricular contraction to occasion any sound whatever. But in most persons the process of auscultation is in itself an excitant of the nervous system, which will commonly cause an increased action of the heart, and if obstructive disease, however slight, should exist, more or less physical signs will, in most cases, be perceptible.

Laying aside therefore, the very rare exception, we have just mentioned, we may with safety conclude that whenever any considerable amount of valvular disease exists, there must of necessity be occasioned an abnormal or unnatural sound, which, perhaps, always indicates in some measure at least, the position, nature, and extent of the derangement. We may also infer that whenever an unnatural sound is observed, it cannot be the result of a natural or physiological performance of the hearts functions, and must, therefore, be considered as the physical sign of some change either in the structure or function of the heart, or of the organs which surround it.